

REMARKS

This paper is being presented in response to the final official action dated April 19, 2007, wherein: **(a)** claims 1, 2, 4, 7, and 8 are pending; **(b)** claims 1, 4, 7, and 8 have been rejected under 35 USC § 103(a) as being obvious over Meador et al. (2003) *Proc. SPIE* 5039:948-59, in view of Takano et al. U.S. Patent No. 6,692,892 and Fukushige et al. U.S. Patent No. 6,190,824 “evidenced by” Wolf, *Silicon Processing for the VLSI Era*, at 308 (Lattice Press 1986), Barclay et al. (2003) *Proc. SPIE* 5039:433-41, and Andrieu et al. U.S. Patent No. 6,261,721; and, **(c)** claim 2 has been rejected under § 103(a) as being obvious over the Meador publication, the Takano and Fukushige patents as applied to the rejection of claims 1, 4, 7, and 8, and further in view of Shibata et al. (2002) *Proc. SPIE* 4690:773-81. Reconsideration and withdrawal of the rejections are respectfully requested in view of the following remarks.

This paper also is being presented in accordance with 37 CFR § 1.116(e) in an effort to place the application in condition for allowance. The arguments presented herein were not (and could not have been) presented in prior communications to the U.S. Patent and Trademark Office (Patent Office) due to the applicants' good faith belief that all prior rejections had been overcome by amendment and/or argument. Indeed, the all prior rejections were overcome by amendment and argument. The current action, however, applies additional, new, publications to support its new § 103(a) rejections of the pending claims. This paper responds to those new rejections.

I. Acknowledgement of the Applicants' Foreign Priority Benefit Claim

The paper transmitting the above-captioned patent application to the Patent Office, and the applicants' oath/declaration accompanying the application's filing identified the applicants' timely claim for the benefit of the June 27, 2003, filing date of Korean patent application No. 10-2003-0042523. The transmittal paper also forwarded a certified copy of the Korean application (priority document), as evidenced by the Patent Office-stamped post-card receipt accompanying the paper and a recent 2-page PAIR IFW print-out. Copies of the post-card receipt and the PAIR IFW print-out are appended hereto. The Patent Office official filing receipt mailed February 23, 2004, acknowledges the foreign application and its filing date. However, the “Office Action Summary” sheet accompanying the current action and similar sheets accompanying prior Patent Office actions* do not include the “X” designation in box “12” and subsidiary boxes “a” and “1,” acknowledging the applicants' claim for foreign priority benefit and the Patent Office's receipt of the certified copy of the priority document. Accordingly, the applicants respectfully request that the Patent Office affirmatively

* See Official Action dated July 6, 2005; Official Action dated October 18, 2005; Official Action dated April 10, 2006; Official Action dated October 25, 2006.

acknowledge (i) the applicant's foreign priority benefit claim and (ii) its receipt of the priority document in the next action on the merits.

II. The 35 USC § 103(a) Rejection

Claims 1, 4, 7, and 8 have been rejected under 35 USC § 103(a) as being obvious over:

- (a) Meador et al. (2003) *Proc. SPIE* 5039:948-59, "in view of"
- (b) Takano et al. U.S. Patent No. 6,692,892, and
- (c) Fukushige et al. U.S. Patent No. 6,190,824 "evidenced by"
 - (i) Wolf, *Silicon Processing for the VLSI Era*, at 308 (Lattice Press 1986),
 - (ii) Barclay et al. (2003) *Proc. SPIE* 5039:433-41, and
 - (iii) Andrieu et al. U.S. Patent No. 6,261,721.

See the Action at pp. 2-6. Claim 2 has been rejected under § 103(a) as being obvious over:

- (a) the Meador publication, the Takano patent, and the Fukushige patent as applied to the rejection of claims 1, 4, 7, and 8, and further in view of
- (b) Shibata et al. (2002) *Proc. SPIE* 4690:773-81.

See the Action at pp. 6-7. A response to the obviousness rejection is set forth below.

A. Proper Basis for a § 103(a) Rejection

The Patent Office "has the burden under § 103 to establish a prima facie case of obviousness." *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988). To establish a prima facie case of obviousness, the Patent Office must show that the combined disclosure of the prior art references teaches or suggests all of the claimed elements. See MPEP § 2143 (8th ed., Rev. 5, Aug. 2006). It is "incumbent upon the examiner to identify wherein each and every facet of the claimed invention is disclosed in the applied reference." *Ex parte Levy*, 17 USPQ2d 1461, 1462 (Bd. Pat. App. & Inter. 1990). The Patent Office also must demonstrate that a person having ordinary skill in the art would have a reasonable expectation of success when combining a plurality of references that the Patent Office alleges discloses all of the claimed elements. Furthermore, it is important that the Patent Office identify a reason that would have prompted a person having ordinary skill in the art to combine—in the manner claimed—the elements the Patent Office alleges are disclosed in the prior art. *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1731, 1740-41 (2007).

B. The § 103(a) Rejection of Claims 1, 4, 7, and 8 Is Traversed

Claims 1, 4, 7, and 8 have been rejected under 35 USC § 103(a) as being obvious over (a) the Meador publication in view of (b) the Takano patent and (c) the Fukushige patent as evidenced by (i) the Wolf publication, (ii) the Barclay publication, and (iii) the Andrieu publication. See the Action at pp. 2-6. The same combination of publications (less the

Fukushige and Andrieu patents) was applied to reject a prior version of independent claim 1. Following the applicants' amendment to claim 1 and accompanying argument traversing that rejection, the current action acknowledges that the present form of independent claim 1 is not rendered obvious by that prior combination because that combination does not disclose a "water soluble polymer of the gas protection film." See the Action at p. 7. The action, however, maintains the rejection over that prior combination when considered in view of the additional Fukushige and Andrieu patents.

The applicants respectfully submit, however, that the applied publications—even in view of the additional Fukushige and Andrieu patents—*do not* teach or suggest all of the limitations recited in independent claim 1. Furthermore, the primary reference (the Meador publication) applied to support the rejection lacks any structure corresponding to the gas protection film recited in independent claim 1. The action identifies no apparent reason that would have prompted a person having ordinary skill in the art to incorporate such a structure into the method disclosed in the primary reference (the Meador publication). For these independent reasons, the instant action presents no *prima facie* case of obviousness of claims 1, 4, 7, and 8, and no such case exists based on the combination of the publications in the current action. Accordingly, reconsideration and withdrawal of the § 103(a) rejection are respectfully requested.

1. The Claimed Invention

Claim 1 recites a method for forming a photoresist pattern that includes applying a gas protection composition on a photoresist film, where the gas protection composition includes "a water-soluble polymer selected from the group consisting of copolymers of methyl methacrylate and acrylic acid, copolymers of methyl acrylate and acrylic acid, and mixtures thereof" and performing a photolithography process on a resulting structure to form a photoresist film pattern:

1. A method for forming a photoresist pattern comprising:

(a) preparing a gas protection composition comprising a water-soluble polymer selected from the group consisting of copolymers of methyl methacrylate and acrylic acid, copolymers of methyl acrylate and acrylic acid, and mixtures thereof;

(b) forming an etching mask layer on an underlying layer;

(c) applying a photoresist composition including silicon on the etching mask layer to form a photoresist film;

(d) applying the gas protection composition on the photoresist film, thereby forming a gas protection film;

- (e) performing a photolithography process on the resulting structure to form a photoresist film pattern;
- (f) etching the etching mask layer of step (b) using the photoresist film pattern as an etching mask to form an etching mask pattern; and,
- (g) forming an underlying layer pattern by an etching process using the etching mask pattern.

The gas protection film absorbs a silicon gas generated from the resist during an exposure process (see page 4, lines 3-12 of the specification).

2. The Content of the Applied Publications and the Distinctions from the Claimed Invention

(a) The Meador Publication

The Meador publication is directed to a multilayer microlithography system, and was discussed in the applicants' paper entitled "Amendment 'B' After Final Rejection" filed August 7, 2006. Therein, the applicants submitted that the Meador publication discloses only three lithographic layers on a substrate: (1) a bottom antireflective coating ("BARC") applied directly to the substrate, (2) an etching mask layer ("EML"; also referred to as the "middle layer") applied to the BARC layer, and (3) a photoresist layer applied to the EML. See Meador at abstract, § 3.1.6, and Fig. 1. The Meador publication discloses the application of the EML as a solution containing propylene glycol monomethyl ether acetate (PGMEA) as a solvent for its undisclosed polymeric ingredient containing silicon. See Meador at § 3.1.1 and Table 1. The Meador publication further discloses the application of the BARC layer as a solution containing PGMEA, propylene glycol monomethyl ether, and/or propylene glycol monopropyl ether as a solvent for its undisclosed polymeric ingredient. See Meador at § 3.2 and § 3.2.1.

In contrast to the claimed method, the Meador publication discloses a photoresist and an etching mask layer (EML) comprising a silicon-containing polymer, wherein the EML is formed beneath the photoresist—not on the photoresist. See Meador at § 3.1.6 (stating that the trilayer film "configurations were comprised of a 193-nm photoresist coated on top of an EML"); *see also*, Official Action at 8 (dated October 25, 2006) (stating that the Meador publication "does not disclose a gas protectant film formed on a photo resist layer"). In further contrast to the claimed method, the silicon-containing polymer material of the EML disclosed in the Meador publication is different from the water-soluble polymer material for forming the gas protection (composition) layer of the presently claimed method.

(b) The Takano Patent

The Takano patent discloses an anti-reflective coating composition—not a gas protection film—that is formed on a photoresist layer, where the anti-reflective coating includes *at least* (a) polyacrylic acid, (b) polyvinyl pyrrolidone, (c) perfluoro alkylcarboxylic

acid, and (d) tetramethyl ammonium hydroxide. Each of these materials is an essential ingredient in the coating composition disclosed in the Takano patent. The Takano patent teaches that the coating composition disclosed therein “prevents reflection of incident light and substrate-reflected light at the surface of a resist upon formation of pattern by lithography” processes. See the Takano patent at col. 1, lines 8-10.

In contrast to the claimed method, the anti-reflective coating composition disclosed in the Takano patent is different from the water-soluble polymer material for forming the gas protection (composition) layer of the presently claimed method, and the anti-reflective coating cannot function as a gas protection layer.

(c) The Fukushige Patent

The Fukushige patent teaches a photosensitive composition that includes a polymerizable monomer, polymerization inhibitor, and a diazonium salt. The photosensitive composition further includes an organic binder polymer including polyacrylic acid, polymethyl acrylate, and a copolymer thereof.

The photosensitive composition disclosed in the Fukushige patent functions as photoresist—not a silicon gas protection layer. That is, in contrast to the claimed method, the Fukushige patent does not disclose a gas protection film formed on a silicon-containing photoresist, wherein the film includes a water-soluble polymer.

(d) The Wolf Publication

The Wolf publication is cited as evidence for the function of a photoresist and the outgassing of silicon-containing polymers. See the Action at p. 3.

(e) The Barclay Publication

Although the Barclay publication is cited in the current action to reject claims 1, 4, 7, and 8, the action identifies no pertinent disclosures therein to support the rejection of these claims. *Contra Ex parte Levy*, 17 USPQ2d at 1462 (stating that it is “incumbent upon the examiner to identify wherein each and every facet of the claimed invention is disclosed in the applied reference”).

(f) The Andrieu Patent

The Andrieu patent discloses a cell having a separator comprising a macro-porous matrix selected from the polymethyl methacrylate, polymethyl acrylate, polyvinyl pyrrolidone and so forth (see column 2, line 7~29). In contrast to the claimed method, however, the Andrieu patent does not disclose a gas protection film formed on the silicon-containing photoresist, and does not disclose a gas protection film that includes a water-soluble polymer.

3. The Cited Publications Do Not Teach or Suggest All of the Elements Recited in Independent Claim 1

In view of the foregoing, the applied publications *do not* teach or suggest all of the elements recited in independent claim 1. None of the publications applied to reject independent claim 1 (i.e., the Takano, Andrieu, and Fukushige patents, and the Meador, Barclay, and Wolf publications) discloses a gas protecting film formed on a silicon-containing-photoresist layer, wherein the film includes a water-soluble polymer, as recited in independent claim 1. Given these shortcomings, the applicants respectfully submit that the claimed invention is unobvious. Accordingly, reconsideration and withdrawal of the rejection are requested.

4. The Action Identifies No Apparent Reason to Combine the Teachings of the Applied Publications

The primary reference (the Meador publication) applied to support the rejection lacks any structure corresponding to the gas protection film recited in independent claim 1. The action identifies no apparent reason that would have prompted a person having ordinary skill in the art to incorporate such a structure into the method disclosed in the primary reference (the Meador publication). The citations to the Wolf and Barclay publications do not remedy this deficiency.

The anti-reflective coating composition disclosed in the Takano patent includes TMAH as an essential element (see Section II.B.2(b), above), and the photosensitive composition disclosed in the Fukushige patent includes a diazonium salt as an essential element (see Section II.B.2(c), above). These types of alkali components—TMAH and diazonium salt—may neutralize the acid generated from the photoresist layer during an exposure process, thus making it difficult to even form a vertical photoresist pattern. Consequently, a person having ordinary skill in the art would not be prompted to consider these patents as describing ingredients useful to modify the method disclosed in the primary reference (the Meador publication).

Given these additional shortcomings, the applicants respectfully submit that the claimed invention is unobvious. Accordingly, reconsideration and withdrawal of the rejection are requested.

C. The § 103(a) Rejection of Claim 2 Is Traversed

Claim 2 recites the method of claim 1 further comprising “forming the etching mask layer of step (a) by coating an i-line photoresist or KrF photoresist.”

The rejection of claim 2 is premised on the propriety of the obviousness rejection of claims 1, 4, 7, and 8 because it applies the Meador publication, the Takano patent, and the Fukushige patent in the same manner as those publications were applied to reject claims 1, 4,

7, and 8. The rejection of claim 2 further relies on the disclosure in the Shibata publication because the Patent Office believes that the Shibata publication discloses a KrF photoresist.

The applicants respectfully submit, however, that the deficiencies in the rejection of claims 1, 4, 7, and 8, are not remedied by the disclosure found in the Shibata publication. Consequently, whether or not the Shibata publication discloses a KrF photoresist, other elements of claim 1 remain undisclosed in the applied prior art. Because the publications applied to reject claim 2 *do not* teach or suggest all of the elements recited in claim 2 (and claim 1 from which it depends), the instant action presents no prima facie case of obviousness. Accordingly, reconsideration and withdrawal of the § 103(a) rejection are respectfully requested.

Prima facie obviousness under § 103 is a legal conclusion—not a fact. *In re Rinehart*, 531 F.2d 1048, 1052 (CCPA 1976). The foregoing response identifies facts (e.g., evidence in the form of statements in the prior art) rebutting the alleged legal conclusion that the claimed invention is prima facie obvious. All of these facts must be evaluated along with the facts on which the legal conclusion was originally reached—not the legal conclusion itself. Having requested herein reconsideration of the legal conclusion set forth in the official action, the Patent Office is obligated to address all of the evidence and base its forthcoming legal conclusion(s) on such evidence, uninfluenced by its earlier conclusions. *Id.*

CONCLUSION

In view of the foregoing, acknowledgement of the applicants' claim for foreign priority benefit, reconsideration and withdrawal of the § 103(a) rejection, and allowance of all pending claims 1, 2, 4, 7, and 8 are respectfully requested.

Should the examiner wish to discuss the foregoing, or any matter of form or procedure in an effort to advance this application to allowance, the examiner is urged to contact the undersigned attorney.

Respectfully submitted,

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APPENDIX

30205/39513

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THE PATENT OFFICE IS HEREBY REQUESTED TO ACKNOWLEDGE RECEIPT OF THE FOLLOWING PAPERS BY STAMPING & RETURNING THIS CARD.

WITH SERIAL NO. AND FILING DATE:

HWANG "Methods for forming fine photoresist..."

Patent Application Transmittal under 37 C.F.R. §1.53 (& copy)

Title Page, Specification 4 pages; Claims 3 Pages;

Abstract; Drawings 4 pages, Executed Declaration,

Transmittal of Priority Document Korean patent application;

Information Disclosure Statement & PTO-1449 w/: 1U, 1F

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APPENDIX

10/719,083 Methods for forming fine photoresist patterns 07-18-
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